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(56) Documents cited
GB 2180436 A GB 2119218 A GB 1585456 A
GB 1036057 A EP 0287081 A

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Online databases: WPI, US CLAIMS

(54) Improved method of manufacturing soya milk

(57) A method of producing and preparing for distribution soya milk comprising mixing together shelled and finely-divided soya beans with water at a temperature between 60°C and 90°C. The mixture of finely-divided beans and water is ground and subjected to heating and cooling in order to encourage spore germination. This is followed by a sterilising heat treatment to kill any germinating spores. The heating also deactivates trypsin inhibitor and reduces tainting flavours. Trisodium citrate and tripotassium phosphate are added to the water beforehand so that calcium lactate can be added without the formation of a precipitate. After a sterilising heat treatment the milk is homogenised and then packaged under aseptic conditions into aseptic packing containers. The milk has a superior flavour and storage properties.

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Fig.1

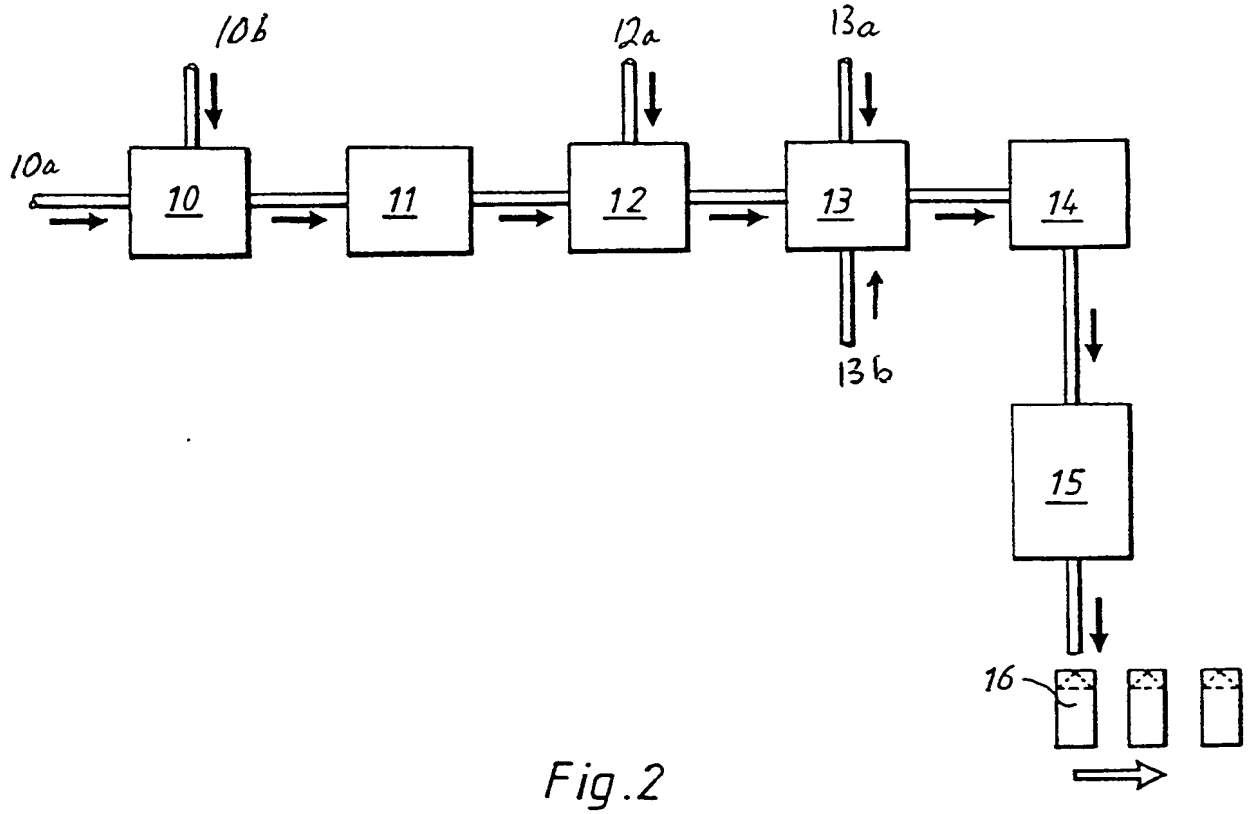
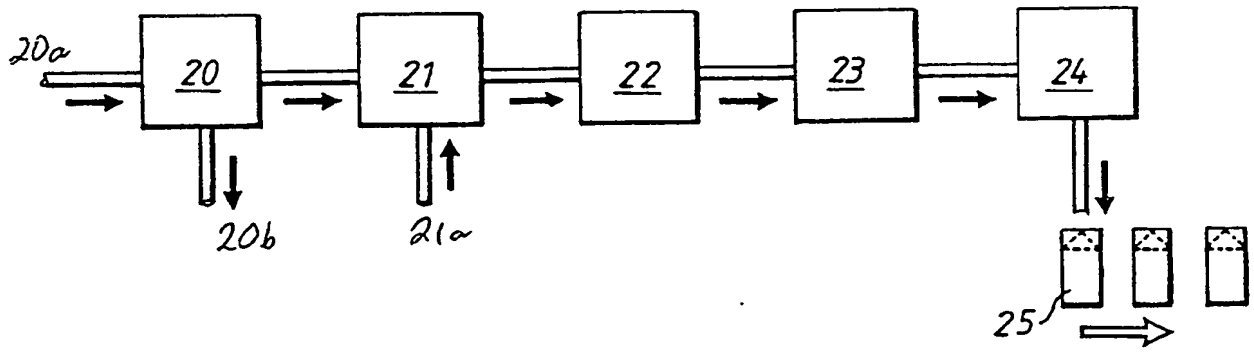


Fig.2



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IMPROVED METHOD OF MANUFACTURING SOYA MILK

The present invention relates to a method of producing soya milk and preparing it for distribution in a ready-to-drink form.

A known method of producing soya milk is to mix soya beans with water and then press the milk from the mixture of beans and water. The remainder, the so-called "ochara", left after pressing the mixture of beans and water is primarily employed as a protein-rich animal feed. A maximum of about 70% of the protein is extracted from the mixture of soya beans and water by pressing. Soya milk is a protein-rich product which has been produced by traditional methods and which is now produced on an industrial scale.

In addition to protein, soya beans contain a trypsin inhibitor. The trypsin inhibitor inactivates trypsin which is the body's peptide bond splitting enzyme. This makes it difficult or impossible for the body to absorb and derive benefit from the protein content of the soya milk. However, it is known that trypsin inhibitor is extremely sensitive to heat and, as a result, easy to destroy or inactivate by heat treatment at a sufficiently elevated temperature. In order to avoid intake of active trypsin inhibitor and a corresponding risk of trypsin inactivation, the conventional method of producing soya milk is combined with an inhibitor-destroying heat treatment. For example, the mixture of soya beans and water may be made in hot water or the resultant mixture can be heated at any time prior to consumption.

The traditional method of production is complicated and so is therefore not suitable to be used for rational, industrial production. Complicated and expensive equipment would be required involving high investment costs. A further disadvantage inherent in the prior art method is that the product is perishable. Intact soya beans are not particularly sensitive to storage, but a dramatic change occurs as soon as the beans are shelled or crushed. Moreover, the beans contain

substances which can taint the flavour of the finished product if the beans are incorrectly handled.

There are techniques available in the art for eliminating such tainting but these make the production process even more complicated. A more complicated process requires a more sophisticated manufacturing plant which in turn means higher investment costs.

Therefore, there is a need for a rational, industrial method of producing soya milk without the disadvantages and drawbacks of the existing processes.

Furthermore, until now it has been considered impossible to enrich soya milk with calcium prior to heat treatment, unless the soya milk has a pH between 4 and 4.5. In experiments where enrichment with calcium has been attempted the result has been precipitation of the product, with deposition of small particles which give a gritty, organoleptic sensation. In order to achieve a stable, homogeneous, calcium-enriched soya milk, it has therefore been found necessary to employ expensive stabilisers in high concentration, which has raised costs and thereby rendered such products economically unattractive.

An object of the present invention is to provide a method for the production of soya milk on a rational industrial scale, without using a complicated production process requiring complicated and expensive equipment. Another object of the invention is to provide soya milk which possesses superior flavour and which has superior storage properties. A further object of the invention is to provide a way of enriching the milk with calcium without using expensive stabilising additives.

The present invention provides a method of producing soya milk comprising mixing soya beans with water, wherein the soya beans are shelled, and finely divided. By using the whole of the bean after shelling, a higher protein yield will be achieved. Approximately 90% of the total protein content of the soya beans is extracted.

The invention also includes a method of producing packaged soya milk comprising the step of mixing shelled and finely divided soya beans with water to produce soya milk and then packaging the soya milk produced into containers, wherein the soya milk packaged into the containers contains substantially all of the solid material of the shelled soya beans used to produce the soya milk.

The shelled and finely divided soya beans are preferably mixed with water at a temperature in the range 60° to 90°C.

The method preferably further comprises the steps of:

(a) subjecting the said mixture of shelled, finely divided soya beans and water to a temperature in the range 80 to 90°C;

(b) cooling the said mixture to a temperature in the range 10 to 15°C;

(c) sterilising the said mixture by heating.

The sterilisation by heating is preferably an ultra high temperature (UHT) treatment.

The said mixture of water and shelled, finely divided soya beans is preferably ground before subjecting it to said heat treatment (a).

The said mixture is preferably homogenised. Homogenisation may take place before or during the heat sterilisation treatment.

Milk may be added to the said mixture at some stage after it has been subjected to said heating (a).

Trisodium citrate and tripotassium phosphate may be added to the water before the said mixing with the shelled and finely divided soya beans and a calcium salt may be added to the said mixture.

The calcium salt is preferably calcium lactate.

Additives such as vitamins may be added to the said mixture. The additives may be added at some stage after it has subjected to said heating (a).

Preferably the soya beans are first dried to a moisture content of from 5 to 7% before being shelled and then finely divided.

The shelled soya beans are preferably finely divided by dry milling.

The shelled and finely divided soya beans may be stored for a period of time before the step of mixing them with water.

The soya milk is preferably packaged into packing containers under aseptic conditions.

The packing containers are preferably made from a laminated packaging material comprising a carrier layer of paper or board; outer, liquid-tight coatings of thermoplastics material and a layer of aluminium foil sandwiched between one thermoplastic coating and the carrier layer.

A preferred method in accordance with the invention will now be described in detail with reference to the accompanying drawings, in which:

Figure 1 is a schematic diagram of a production process for producing soya milk according to the invention based on soya powder; and

Figure 2 is a schematic diagram of a production process used to produce the soya powder from soya beans.

Figure 1 shows schematically six different consecutive steps (10-15) in a preferred method according to the invention. Clearly, some of these steps can be combined with one another in order to streamline the manufacturing process and make it more efficient, however they are shown and will be explained hereinafter separately.

In step 10, soya powder is mixed with water. The soya powder is fed in through inlet 10a and water is fed in through inlet 10b. The intention is to cause the particles of the soya powder to swell so that they will be easier to grind. The relative proportions of water and soya powder may vary, but a ratio of one third soya powder and two thirds water by weight is preferred.

The mixing time depends on the temperature and is between 60 and 70°C, but at most 90°C. A mixing time of from 10 to 15 minutes is sufficient.

The mixture is then passed through a grinder device 11, such as a colloid mill. The purpose here is to ensure a thorough mixture and to grind the soya particles to a suitable particle size for further grinding in a homogenizer.

At step 12 the mixture is heated to and kept at 85-90°C for 30 minutes. The mixture can be diluted with water fed in through inlet 12a if necessary in order to assist the pumping of the mixture. The heat treatment serves three purposes; to destroy or inactivate the heat-sensitive trypsin inhibitor, to reduce tainted flavour, and to reduce contamination by the spores of micro-organisms. After the heat treatment when the temperature is reduced, any spores originally present amongst the raw soya beans and subsequently present in the mixture of soya powder and water begin to germinate. The germinating spores are later exterminated during a UHT (Ultra High Temperature) treatment.

At step 13 the mixture is cooled to 10-15°C and milk and other ingredients are added through inlets 13a and 13b respectively. The mixture is kept at this lower temperature for at least two hours. During this time, the aforementioned germination of the spores takes place.

At step 14 homogenisation and UHT treatment take place. The homogenisation is necessary for a uniform distribution of the raw materials and as a final grinding of the soya powder. The UHT treatment kills off all bacteria and germinating spores.

The UHT-treated product is finally packaged at step 15 under aseptic conditions into consumer packages 16 produced from sterilised packaging material.

The aseptic consumer packages are produced from a laminated packaging material of the type which has a carrier layer of paper; outer, watertight coatings of thermoplastic, e.g. polyethylene, and an aluminium foil which is sandwiched

between one of the plastic surface coatings and the carrier layer. The aluminium foil helps to protect the inside of the packages from exposure to light and oxygen. Even if the soya product has a certain tainted flavour when it is packed, this tainting recedes after a relatively short period of storage (about 10 days) in packages produced from this packaging material. Consequently, the packages are advantageous for producing a soya product without tainted flavour and possessing superior storage properties, employing the method according to the present invention.

Sometimes, it may be appropriate to enrich the soya milk with calcium.

The soya milk can be enriched with calcium without incurring the aforementioned problems of the prior art, by adding trisodium citrate and tripotassium phosphate to the water which is to be mixed with the soya powder. The amounts of each salt to be added depends upon the concentration of soya protein and the degree of calcium enrichment which is required as well as the heat treatment. For a soya milk consisting of approximately 50% milk solids, 1.5% soya protein and with a calcium enrichment of from 3:0 to 3:5%, the concentration of trisodium citrate should be 1:5% by weight and tripotassium phosphate (K_3PO_4) 1% by weight. Prior to packing, the remaining ingredients such as milk and vitamins are added. Calcium lactate is added at this stage.

Employing this method of calcium enrichment, a mixture of 50% pure milk and 50% soya protein milk gives an overall calcium concentration of approximately or in excess of 1000 mg calcium per litre, which is comparable with milk. The soya protein milk may be made from a mixture of soya and other vegetable proteins.

The soya powder of shelled, finely divided soya beans is produced as follows with reference to Figure 2. Raw soya beans 20a are sorted 20 and substandard beans, stones and contaminating objects are rejected 20b. After sorting, the beans are heated 21 in hot air 21a to reduce their moisture

content to about 5-7% by weight. The beans are shelled 22 and then dry ground 23 into a powder. The soya powder is packed 24 in plastic bags 25 until such time as they are required for production of soya milk.

The present invention also effectively solves problems and drawbacks previously associated with the conventional soya milk technology. In particular, the present invention makes it possible to produce calcium enriched soya drink possessing superior flavour and storage properties on a rational and industrial scale without requiring the use of expensive and complicated process equipment and without costly additives, as has been necessary until now.

The present invention is not restricted to that specifically described above and shown in the drawings. Many modifications and variations are possible within the scope of the invention.

CLAIMS

1. A method of producing soya milk comprising mixing soya beans with water, wherein the soya beans are shelled, and finely divided.

2. A method as claimed in Claim 1, wherein the shelled and finely divided soya beans are mixed with water at a temperature in the range 60° to 90°C.

3. A method as claimed in Claim 1 or Claim 2, further comprising the steps of:

(a) subjecting the said mixture of shelled, finely divided soya beans and water to a temperature in the range 80 to 90°C;

(b) cooling the said mixture to a temperature in the range 10 to 15°C;

(c) sterilising the said mixture by heating.

4. A method as claimed in Claim 3, wherein the said mixture of water and shelled, finely divided soya beans is ground before subjecting it to said heat treatment (a).

5. A method as claimed in Claim 3 or Claim 4, wherein the said mixture is homogenised at some stage.

6. A method as claimed in any one of Claims 3 to 5, wherein milk is added to the said mixture at some stage after being subjected to said heating (a).

7. A method as claimed in any preceding claim, wherein trisodium citrate and tripotassium phosphate are added to the water before the said mixing with the shelled and finely divided soya beans and a calcium salt is added to the said mixture.

8. A method as claimed in Claim 8, wherein the calcium salt is calcium lactate.

9. A method as claimed in any preceding claim wherein additives such as vitamins are added to the said mixture.

10. A method as claimed in any preceding claim, wherein the soya beans are first dried to a moisture content of from 5 to 7% before being shelled and finely divided.

11. A method as claimed in Claim 10, wherein the shelled soya beans are finely divided by dry milling.

12. A method as claimed in Claim 10 or Claim 11, wherein the shelled and finely divided soya beans are stored for a period of time before the step of mixing with water.

13. A method as claimed in any preceding claims, further comprising the step of packaging the soya milk into packing containers under aseptic conditions.

14. A method as claimed in Claim 13, wherein the packing containers are made from a laminated packaging material comprising a carrier layer of paper or board; outer, liquid-tight coatings of thermoplastics material and a layer of aluminium foil sandwiched between one thermoplastics coating and the carrier layer.

15. A method of producing packaged soya milk comprising the step of mixing shelled and finely divided soya beans with water to produce soya milk and then packaging the soya milk produced into containers wherein the soya milk packaged into the containers contains substantially all of the solid material of the shelled soya beans used to produce the soya milk.

16. A method substantially as herein described or as shown in the drawings.

17. Soya milk manufactured in accordance with a method specified in any one of Claims 1 to 16.

18. A method of producing and preparing for distribution a soya drink possessing superior flavour and storage properties, by mixing soya beans with water, characterised in that shelled, finely-divided beans are employed as raw material.

19. The method as claimed in Claim 18, characterised in that the mixing with water is carried out at 60 to 70°C or higher, but at most 90°C.

20. The method as claimed in Claim 18 or Claim 19, characterised by the steps of:

a) grinding the mixture of water and shelled, finely-divided soya beans;

b) heat treating the mixture of shelled, finely-divided soya beans and water at 85 to 90°C;

c) cooling the mixture to 10 to 15°C and adding milk and other ingredients selected for producing the soya drink;

d) homogenising the cooled mixture;

e) subjecting the mixture, for purposes of sterilisation, to a final heat treatment; and

f) packing the homogenised, sterilised suspension in a consumer package which is sterilised or produced from sterilised packaging material.

21. The method as claimed in any one of Claims 18 to 20, characterised in that the soya drink is packed in consumer packages produced from a laminated packaging material consisting of a carrier layer of paper or board, outer, liquid-tight coatings of thermoplastic and an aluminium foil sandwiched between the inner thermoplastic coating and the carrier layer.

22. A method of producing shelled, finely-divided soya beans for use as starting material in the method as claimed in any one of Claims 18 to 21, characterised by the steps of:

a) sorting and removing substandard beans, stones and other impurities from the untreated raw material of whole soya beans;

b) drying the accepted, whole soya beans to a moisture content of 5 to 7%;

c) shelling the dried whole soya beans; and

d) grinding the shelled, whole soya beans by dry milling.

23. The method as claimed in Claim 22, characterised in that the shelled, finely-divided soya beans are packed and stored in plastic packages prior to use as raw materials in the method as claimed in any one of Claims 18 to 22.

24. A method of producing a calcium-enriched soya drink as claimed in any one of Claims 18 to 22, characterised in that

the water is supplied with trisodium citrate and tripotassium phosphate prior to mixing with the shelled, finely-divided soya beans; and that the mixture is supplied with calcium lactate in a subsequent operational step.

Amendments to the claims
have been filed as follows

1. A method of producing soya milk comprising
   (a) mixing soya beans with water, wherein the soya beans are shelled, and finely divided;
   (b) subjecting the said mixture of shelled, finely divided soya beans and water to a temperature in the range 80 to 90°C;
   (c) cooling the said mixture for a period of time to a temperature in the range 10 to 15°C to encourage micro-organism growth and spore germination;
   (d) sterilising the said mixture by heating.

2. A method as claimed in Claim 1, wherein the shelled and finely divided soya beans are mixed with water in step (a) at a temperature in the range 60° to 90°C.

3. A method as claimed in Claim 1 or Claim 2, wherein the said mixture of water and shelled, finely divided soya beans is ground before subjecting it to said heat treatment (b).

4. A method as claimed in Claim 2 or Claim 3, wherein the said mixture is homogenised at some stage.

5. A method as claimed in any preceding claim, wherein milk is added to the said mixture at some stage after being subjected to said heating (b).

6. A method as claimed in any preceding claim, wherein trisodium citrate and tripotassium phosphate are added to the water before the said mixing with the shelled and finely divided soya beans and a calcium salt is added to the said mixture.

7. A method as claimed in Claim 6, wherein the calcium salt is calcium lactate.

8. A method as claimed in any preceding claim wherein additives such as vitamins are added to the said mixture.

9. A method as claimed in any preceding claim, wherein the soya beans are first dried to a moisture content of from 5 to 7% before being shelled and finely divided.

10. A method as claimed in Claim 9, wherein the shelled soya beans are finely divided by dry milling.

11. A method as claimed in Claim 10 or Claim 11, wherein the shelled and finely divided soya beans are stored for a period of time before mixing with water in step (a).

12. A method as claimed in any preceding claim, further comprising the step of packaging the soya milk into packing containers under aseptic conditions.

13. A method as claimed in Claim 12, wherein the packing containers are made from a laminated packaging material comprising a carrier layer of paper or board; outer, liquid-tight coatings of thermoplastics material and a layer of aluminium foil sandwiched between one thermoplastics coating and the carrier layer.

14. A method substantially as herein described or as shown in the drawings.

15. Soya milk manufactured in accordance with a method specified in any one of Claims 1 to 14.

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Examiner's report to the Comptroller under Section 17 (The Search Report)

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Relevant Technical fields

(i) UK Cl (Edition 5) A2Q: Q7B
C3H: HJ

(ii) Int Cl (Edition)

Search Examiner
B J GARDNER

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASES: WPI, US CLAIMS

Date of Search
20 APRIL 1993

Documents considered relevant following a search in respect of claims 1-24

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2180436 A (KABUSHIKI KAISHA KIBUIN) The whole document	1 and 2, 18 at least
X	GB 2119218 A (THE COCA-COLA CO) See whole document	1 and 2, 18 at least
X	GB 1585456 (ALFA-LAVAL AB) See particularly examples	1 and 2, 18 at least
X	GB 1036057 (NAGO NEHRMITTEL) See whole document	1 and 2, 18 at least
X	EP 0287081 A (SCHUFFER LEBENSMITT)	1 and 2, 18 at least

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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